Claims

1. A method for communicating information over a communications network, comprising:

determining a network location of a target device to which a first frame of information is to be sent, the first frame of information being formatted for a first communications protocol and including a device address field configured to store a device identifier;

selecting, based on the network location of the target device, an addressing scheme from among plural different addressing schemes;

generating the device identifier for the first frame on the basis of the selected addressing scheme, the device identifier corresponding to the target device;

encapsulating the first frame of information in a second frame of information formatted for a second communications protocol, the second frame including a destination address field;

generating a destination address for the second frame on the basis of the device identifier in the device address field of the first frame;

storing the destination address in the destination address field of the second frame; and

transmitting the second frame of information over the communications network.

2. The method of claim 1, wherein the first frame of information comprises a MODBUS frame, and the second frame of information comprises an IP packet that encapsulates a TCP frame encapsulating the MODBUS frame.

3. The method of claim 1, further comprising encapsulating the second frame in an Ethernet frame prior to transmitting the second frame.

4. The method of claim 1, wherein the step of determining the network location comprises determining that the target device is on a local network; and

wherein the step of generating the destination address comprises substituting the device identifier for at least a portion of the destination address in the destination address field.

5. The method of claim 1, wherein the step of determining the network location comprises determining that the target device is coupled to a subnet gateway of a subnet, the

target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of the subnet gateway; and

wherein the step of generating the device identifier comprises adding the subnet identifier to the product of the port identifier and a predetermined constant.

6. The method of claim 5, further comprising:

receiving the second frame at the subnet gateway;

dividing the device identifier by the predetermined constant to generate a quotient and a remainder;

determining the port identifier from the quotient;

determining the subnet identifier from the remainder; and

routing the first frame to the target device based on the port identifier and the subnet identifier.

7. The method of claim 1, wherein the step of determining the network location comprises determining that the target device is on a remote network; and

wherein the step of generating the device identifier comprises determining the device identifier from an address table entry that uniquely identifies the target device.

8. The method of claim 1, wherein the device identifier has a numeric value in one of plural ranges, each of the plural ranges corresponding to one of the plural addressing schemes.

9. The method of claim 1, wherein the step of determining comprises determining if the target device is (a) on a local network and not on a subnet, (b) on a remote network, or (c) is on a local subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of a subnet gateway, the port coupling the target device to the subnet gateway;

wherein the step of generating the device identifier comprises:

adding the subnet identifier to the product of the port identifier and a predetermined constant, if the target device is on the subnet; and

determining the device identifier from an address table entry that uniquely identifies the destination address and the target device, if the target device is on the remote network; and

wherein the step of generating the destination address comprises substituting the device identifier for at least a portion of the destination address in the destination address field, if the target device is on the local network and not on the subnet.

10. A computer readable medium containing program instructions for execution on a computer system, which when executed by the computer system, cause the computer system to perform the method steps for communicating information over a communications network, said method comprising the steps of:

determining a network location of a target device to which a first frame of information is to be sent, the first frame of information being formatted for a first communications protocol and including a device address field configured to store a device identifier;

selecting, based on the network location of the target device, an addressing scheme from among plural different addressing schemes;

generating the device identifier for the first frame on the basis of the selected addressing scheme, the device identifier corresponding to the target device;

encapsulating the first frame of information in a second frame of information formatted for a second communications protocol, the second frame including a destination address field;

generating a destination address for the second frame on the basis of the device identifier in the device address field of the first frame;

storing the destination address in the destination address field of the second frame; and

transmitting the second frame of information over the communications network.

11. The computer readable medium of claim 10, wherein the step of encapsulating the first frame of information comprises a MODBUS frame, and the second frame of information comprises an IP packet that encapsulates a TCP frame encapsulating the MODBUS frame.

12. The computer readable medium of claim 10, wherein the computer readable medium further comprises the step of encapsulating the second frame in an Ethernet frame prior to transmitting the second frame.

13. The computer readable medium of claim 10, wherein the step of determining the network location comprises determining that the target device is on a local network; and

wherein the step of generating the destination address comprises substituting the device identifier for at least a portion of the destination address in the destination address field.

14. The computer readable medium of claim 10, wherein the step of determining the network location comprises determining that the target device is coupled to a subnet gateway of a subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of the subnet gateway; and

wherein the step of generating the device identifier comprises adding the subnet identifier to the product of the port identifier and a predetermined constant.

15. The computer readable medium of claim 14, wherein the computer readable medium further comprises the step of:

receiving the second frame at the subnet gateway;

dividing the device identifier by the predetermined constant to generate a quotient and a remainder;

determining the port identifier from the quotient;

determining the subnet identifier from the remainder; and

routing the first frame to the target device based on the port identifier and the subnet identifier.

16. The computer readable medium of claim 10, wherein the step of determining the network location comprises determining that the target device is on a remote network; and

wherein the step of generating the device identifier comprises determining the device identifier from an address table entry that uniquely identifies the target device.

17. The computer readable medium of claim 10, wherein the device identifier has a numeric value in one of plural ranges, each of the plural ranges corresponding to one of the plural addressing schemes.

18. The computer readable medium of claim 10, wherein the step of determining comprises determining if the target device is (a) on a local network and not on a subnet, (b) on a remote network, or (c) is on a local subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of a subnet gateway, the port coupling the target device to the subnet gateway;

wherein the step of generating the device identifier comprises:

adding the subnet identifier to the product of the port identifier and a predetermined constant, if the target device is on the subnet; and

determining the device identifier from an address table entry that uniquely identifies the destination address and the target device, if the target device is on the remote network; and

wherein the step of generating the destination address comprises substituting the device identifier for at least a portion of the destination address in the destination address field, if the target device is on the local network and not on the subnet.

19. A system for communicating information over a communications network, comprising:

means for determining a network location of a target device to which a first frame of information is to be sent, the first frame of information being formatted for a first communications protocol and including a device address field configured to store a device identifier;

means for selecting, based on the network location of the target device, an addressing scheme from among plural different addressing schemes;

means for generating the device identifier for the first frame on the basis of the selected addressing scheme, the device identifier corresponding to the target device;

means for encapsulating the first frame of information in a second frame of information formatted for a second communications protocol, the second frame including a destination address field;

means for generating a destination address for the second frame on the basis of the device identifier in the device address field of the first frame;

means for storing the destination address in the destination address field of the second frame; and

means for transmitting the second frame of information over the communications network.

20. The system of claim 19, wherein the first frame of information comprises a MODBUS frame, and the second frame of information comprises an IP packet that encapsulates a TCP frame encapsulating the MODBUS frame.

21. The system of claim 19, further comprising encapsulating the second frame in an Ethernet frame prior to transmitting the second frame.

22. The system of claim 19, wherein the means for determining the network location comprises means for determining that the target device is on a local network; and

wherein the means for generating the destination address comprises means for substituting the device identifier for at least a portion of the destination address in the destination address field.

23. The system of claim 19, wherein the means for determining the network location comprises means for determining that the target device is coupled to a subnet gateway of a subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of the subnet gateway; and

wherein the means for generating the device identifier comprises means for adding the subnet identifier to the product of the port identifier and a predetermined constant.

24. The system of claim 23, further comprising:

means for receiving the second frame at the subnet gateway;

means for dividing the device identifier by the predetermined constant to generate a quotient and a remainder;

means for determining the port identifier from the quotient;

means for determining the subnet identifier from the remainder; and

means for routing the first frame to the target device based on the port identifier and the subnet identifier.

25. The system of claim 23, wherein the subnet gateway comprises a bridge multiplexer.

26. The system of claim 19, wherein the means for determining the network location comprises means for determining that the target device is on a remote network; and

wherein the means for generating the device identifier comprises means for determining the device identifier from an address table entry that uniquely identifies the target device.

27. The system of claim 19, wherein the device identifier has a numeric value in one of plural ranges, each of the plural ranges corresponding to one of the plural addressing schemes.

28. The system of claim 19, wherein the target device is a programmable logic controller and the system further comprises the programmable logic controller.

29. The system of claim 19, wherein means for determining comprises means for determining if the target device is (a) on a local network and not on a subnet, (b) on a remote network, or (c) is on a local subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of a subnet gateway, the port coupling the target device to the subnet gateway;

wherein the means for generating the device identifier comprises:

means for adding the subnet identifier to the product of the port identifier and a predetermined constant, if the target device is on the subnet; and

means for determining the device identifier from an address table entry that uniquely identifies the destination address and the target device, if the target device is on the remote network; and

wherein the means for generating the destination address comprises means for substituting the device identifier for at least a portion of the destination address in the destination address field, if the target device is on the local network and not on the subnet.

30. A system for communicating information over a communications network, comprising:

a memory having embodied therein information of the communications network and network protocols;

a processor in communication with the memory and configured to:

determine a network location of a target device to which a first frame of information is to be sent, the first frame of information being formatted for a first communications protocol and including a device address field configured to store a device identifier;

select, based on the network location of the target device, an addressing scheme from among plural different addressing schemes;

generate the device identifier for the first frame on the basis of the selected addressing scheme, the device identifier corresponding to the target device;

encapsulate the first frame of information in a second frame of information formatted for a second communications protocol, the second frame including a destination address field;

generate a destination address for the second frame on the basis of the device identifier in the device address field of the first frame;

store the destination address in the destination address field of the second frame; and

transmitting the second frame of information over the communications network.

31. The system of claim 30, wherein the first frame of information comprises a MODBUS frame, and the second frame of information comprises an IP packet that encapsulates a TCP frame encapsulating the MODBUS frame.

32. The system of claim 30, further comprising encapsulating the second frame in an Ethernet frame prior to transmitting the second frame.

33. The system of claim 30, wherein the processor is further configured to substitute the device identifier for at least a portion of the destination address in the destination address field when the target device is on a local network.

34. The system of claim 30, wherein, the processor is configured to generate the device identifier by adding a subnet identifier to the product of a port identifier and a predetermined constant when the target device is coupled to a subnet gateway of a subnet, the target device being identified on the subnet by the subnet identifier and by the port identifier, the subnet identifier corresponding to the subnet and the port identifier corresponding to a port of the subnet gateway.

35. The system of claim 34, wherein the system further comprises the subnet gateway and the subnet gateway is configured to:

receive the second frame at the subnet gateway;

divide the device identifier by the predetermined constant to generate a quotient and a remainder;

determine the port identifier from the quotient;

determine the subnet identifier from the remainder; and

rout the first frame to the target device based on the port identifier and the subnet identifier.

36. The system of claim 34, wherein the system further comprises the subnet gateway and the subnet gateway comprises a bridge multiplexer.

37. The system of claim 30, wherein the processor is further configured to determining the device identifier from an address table entry that uniquely identifies the target device when the target device is on a remote network.

38. The system of claim 30, wherein the device identifier has a numeric value in one of plural ranges, each of the plural ranges corresponding to one of the plural addressing schemes.

39. The system of claim 30, wherein the system further comprises the target device and the target device comprises a programmable logic controller.

40. The system of claim 30, wherein the processor is further configured to:

determine if the target device is (a) on a local network and not on a subnet, (b) on a remote network, or (c) is on a local subnet, the target device being identified on the subnet by a subnet identifier corresponding to the target device and by a port identifier corresponding to a port of a subnet gateway, the port coupling the target device to the subnet gateway;

add the subnet identifier to the product of the port identifier and a predetermined constant, if the target device is on the subnet;

determine the device identifier from an address table entry that uniquely identifies the destination address and the target device, if the target device is on the remote network; and

generate the destination address by substituting the device identifier for at least a portion of the destination address in the destination address field, if the target device is on the local network and not on the subnet.